Figures 72 and 73 show the contour plot of the predicted field strengths for the Boulder–Denver area for a transmitter located at Eldorado Mountain for frequencies of 533 MHz and 772 MHz, respectively. These results were calculated for a transmitter antenna height of 116 m (379 ft), a receiver height of 9.14 m (30 ft), and 1 MW EIRP. Figures 74 and 75 show the contour plots of the predicted field strengths for the Boulder–Denver area for a transmitter located on Squaw Mountain for 533 MHz and 772 MHz, respectively. These results were calculated for a transmitter antenna height of 60.96 m (200 ft), a receiver height of 9.14 m (30 ft), and 1 MW EIRP.

One might ask how transmitter locations would affect DTV reception. Of interest here are the locations where the 41 dBμV/m (0.11 mV/m) FCC field strength is exceeded. If 41 dBμV/m is exceeded, DTV reception is possible according to the FCC's assumptions. The data shown in figures 72 through 75 are re-plotted to illustrate where the FCC's minimum field strength is met or exceeded. These new results are shown in figures 76 through 79. In figures 76 through 79, the white areas in the plot correspond to where the FCC's minimum field strength is exceeded. The blue shaded areas indicate areas with field strengths that are below the FCC's minimum field strength recommendation for DTV reception. These blue areas indicate that DTV may not be received in these areas, as indicated by the FCC's recommendation. Note that as far as the FCC's 41 dBμV/m (0.11 mV/m) recommendation is concerned, it is seen in figures 76 through 79 that Squaw Mountain covers basically the same area as a transmitter on Eldorado Mountain, for the purposes of DTV reception with a 9.14 m (30 ft) height fixed receiving antenna. Based on the results in the previous section, while the Squaw Mountain site covers the same area as the Eldorado Mountain site, the Squaw Mountain site does not violate the regulatory field strength limits protecting the Table Mountain NRQZ. The Squaw Mountain site would also provide additional protection to the DOC Laboratories. Note that if a 1.64 MW EIRP is used, the 41dBμV/m recommendation limits would extend the DTV coverage area.

7. ANTENNA PATTERN EFFECTS

All the predicted E-field strengths presented in this report were obtained with the assumption that the transmitting antenna was an omnidirectional antenna. The measurement data presented here were collected with antennas with moderate antenna patterns, i.e., a 1.9 dBi omni-azimuthal directional antenna on the Eldorado Mountain site and a 6.5 dBi log-periodic antenna on the Squaw Mountain site. The actual antennas that will be used for the proposed tower will have some type of antenna pattern associated with them. The ITM propagation model presented here has a capability of using any transmitter antenna pattern in the prediction. Unfortunately, at this time we do not have information on the antenna patterns. At a later date, when and if such antenna patterns are available, new predicted E-field strengths will be calculated.

With this noted, the results in this report can still be used once the actual antenna patterns are known, as explained in the following. When LOS propagation conditions are present, the simple free-space calculation given in equation (2) can be used to determine the E-field strengths without the need to resort to the ITM prediction model. LOS situations occur for the Eldorado Mountain site for the Boulder area. For a transmitter location on Eldorado Mountain, many locations throughout the Boulder area (including the DOC Laboratories and the Table Mountain NRQZ) exhibit LOS paths. The ability of the simple free-space calculation given in equation (2) to predict E-field strengths in a LOS situation is illustrated in figures 11 and 12. These figures show the measured E-field strengths for a transmitter located on Eldorado Mountain for the DOC Laboratories and the Table Mountain NRQZ. Notice that the free-space calculation correlates very well with the measured data. There is some variability in the measured data, due to multipath effects that the free-space model cannot account for, but typical E-field strengths at both sites are very well accounted for with the free-space model.

Thus, once the actual antenna patterns are known, the EIRP in any direction can be obtained, and equation (2) can be used to estimate the E-field strengths in the LOS situation. An alternative approach is to simply scale the results in this report by the appropriate EIRP for an antenna at a given location and a given direction. From the results in figure 12, it is seen that, for a transmitter on Eldorado Mountain, a reduction of 23 dB in either the transmitter power level or in the antenna gain is needed to achieve the FCC NRQZ limit.

8. EFFECTS OF BROADBAND TRANSMISSION ON SENSITIVE MEASUREMENTS

Historically, the radio science programs in the former National Bureau of Standards (those programs are now in NIST and ITS) drove the need to establish a field site remote from their Washington, DC, laboratories. Boulder was chosen over several contenders because of the relatively quiet radio-frequency electromagnetic environment, which would allow for more accurate measurements and experiments; the varied geographic terrain, which would facilitate the study of radio propagation; and the presence of a major university (the University of Colorado) as well as the proximity of a large city (Denver). The technical mission of the Boulder labs was to develop the most accurate possible reference standards and calibration services to insure compatibility of the emerging radio, microwave, and radar technologies that the nation was then developing. Radio propagation research was fundamental to this work, and as higher frequencies were explored, the interactions between electromagnetic waves and atmospheric layers led to new directions of research. This work was, and continues to be, fundamental to all of the advances made in radio-frequency technology. NIST's research on accurate measurement systems, and its development of standards and calibration services for the Nation, play an essential role in making possible the technologies that we use daily such as wireless communication, high-speed digital technology, time-and-frequency synchronization, satellite communications, radar, and optical fiber communications links, to name only a few.

Radio research projects performed outdoors often require that receivers be constructed to receive wideband signals. Furthermore, those receivers must often be constructed with high performance, low noise amplifiers (LNAs) in the so-called front-end, just after the receive antenna. The requirement for wide bandwidth means that such receivers integrate